Computer Assignment 6

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Part B

Of course, gradient sparsification and quantization are two options we investigated in this assignment, but they are more options. We can suggest more techniques here, some of which were mentioned in the third part of our previous assignment.

1. Communication Network: Firstly, we can use a multi-agent or decentralized communication network instead of a master/worker model. By solving extra optimization problems over the network, we can optimize the communication network. Network optimization should aim to find the sparsest communication graph with the best connectivity. Of course, there is a trade off between connectivity and sparsification of the network. However, we should find the most optimal network resulting in faster convergence in terms of the number of messages transmitted across the network.
2. Local computations: since communication is costly, we can do more local steps, i.e. more gradient computations at each node. In this way, we will communicate less frequently. This approach has been studied in the Federated Learning literature.
3. Communicating less frequently: By considering that after convergence of optimization algorithms, the gradients do not change significantly, we can introduce new algorithms in which the agents communicate to the master node whenever their gradients change significantly. By doing this, we communicate whenever one node's gradient has important information to find the global solution.